



Environmental Public Health Application Systems

ENPHASYS Project: 3rd Annual Review

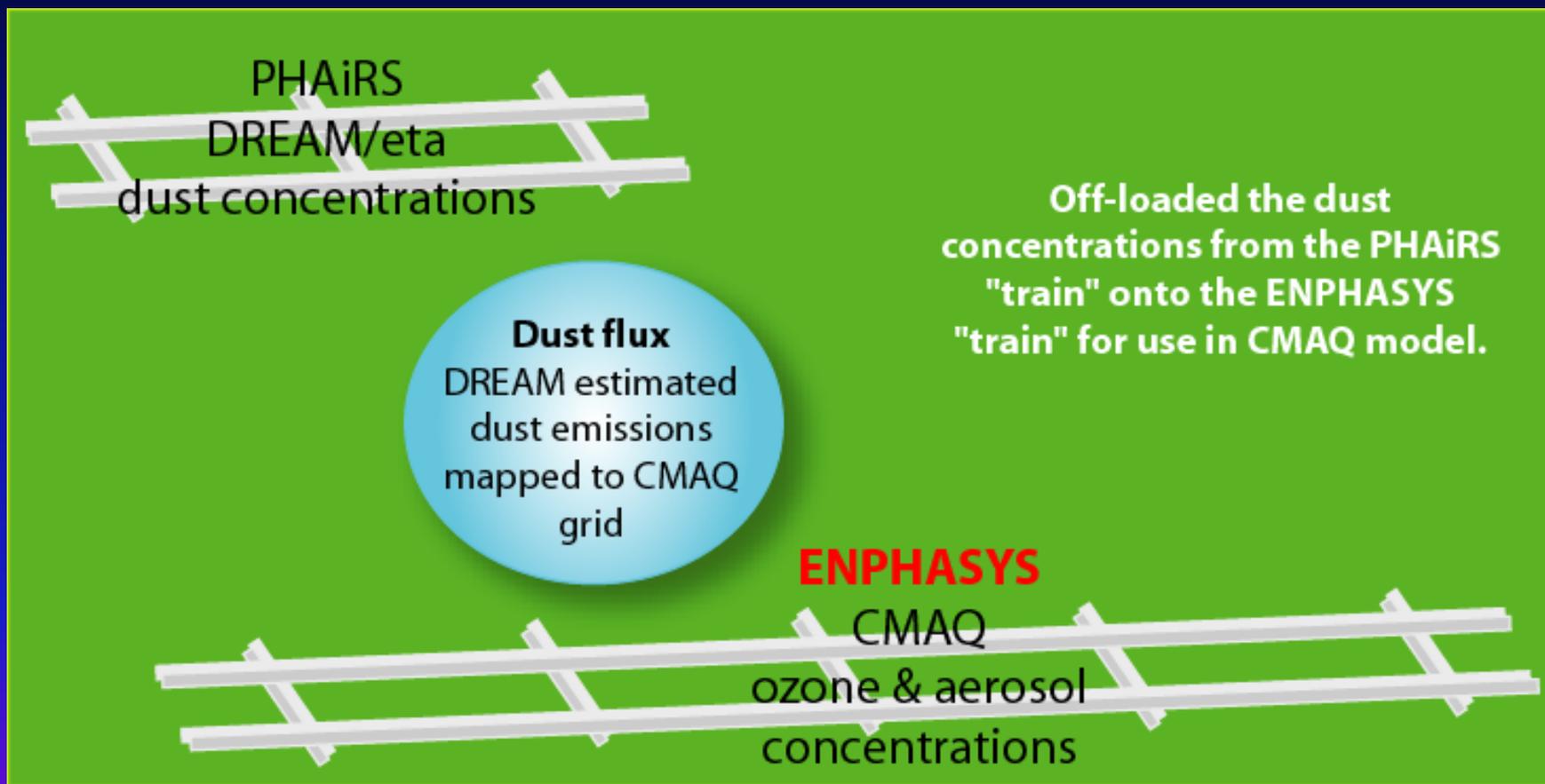
Stan Morain, PI
And
ENPHASYS Team

NASA Public Health Program Review ♦ September 27-28, 2010 ♦ San Antonio, TX





Strategy





Status of Year-3 Tasks

1. Compare MOD12 to MCD12 outputs using & w/o dust source updates
2. Produce daily DREAM outputs using dust masks
3. Produce retrospective model runs of known dust episodes, 2008 & 2009
4. Execute V&V on retrospective and daily model runs
5. Push dust flux output to MSFC for CMAQ modeling of aerosols & ozone
6. Install CMAQ at UNM
7. Execute routine CMAQ model runs for speciated aerosols and ozone
8. Evaluate MODIS AOD for 2006, 2007, & 2008
9. Compare CALIOP curtains with AOD patterns for 2006, 2007, & 2008
10. Assess ability to distinguish anthropogenic from natural air quality episodes
11. Produce twice-monthly dust source distribution updates & evaluate patterns
12. Post-process DREAM/eta and CMAQ model outputs
13. Develop metadata for CMAQ and DREAM/eta products
14. Develop prototype products for EPHTS/N and prototype dust advisories
15. *Environmental Tracking for Public Health Surveillance*

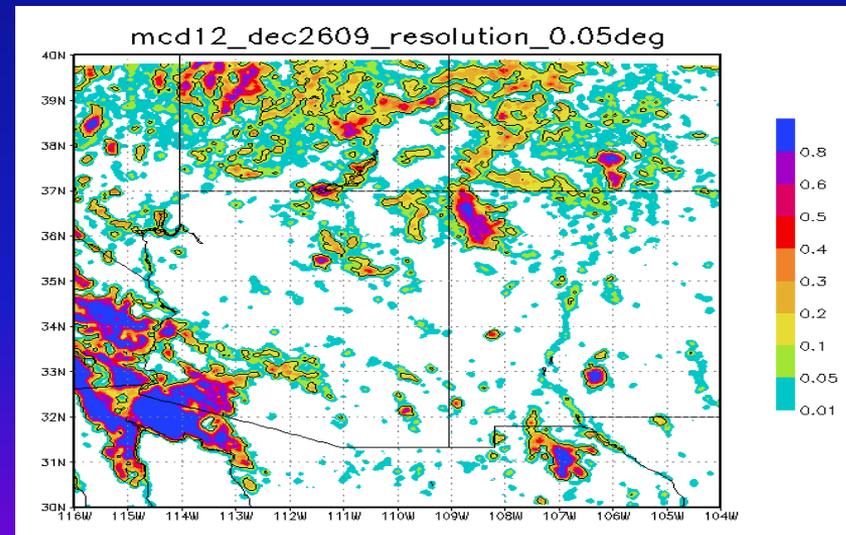
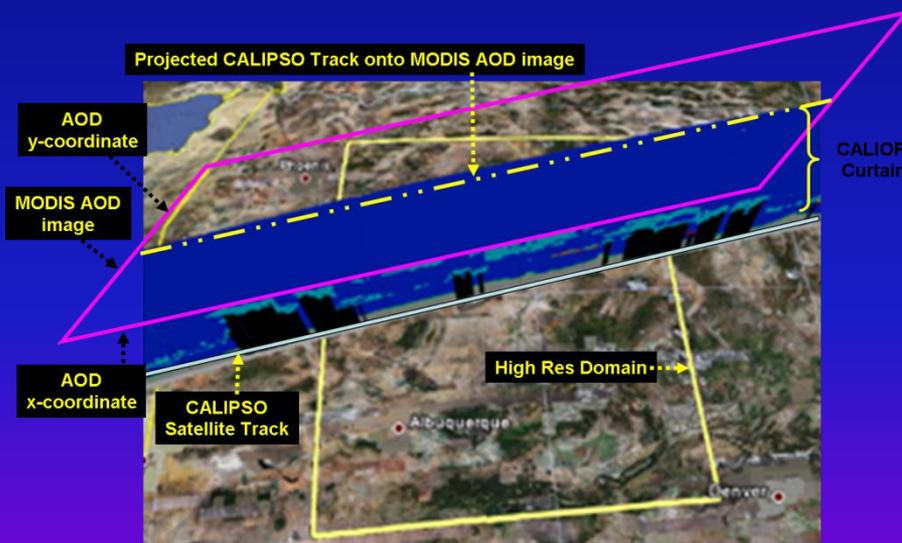
White = completed; Yellow = in progress; Green = needs attention





Accomplishments Oct 2009 to Mar 2010

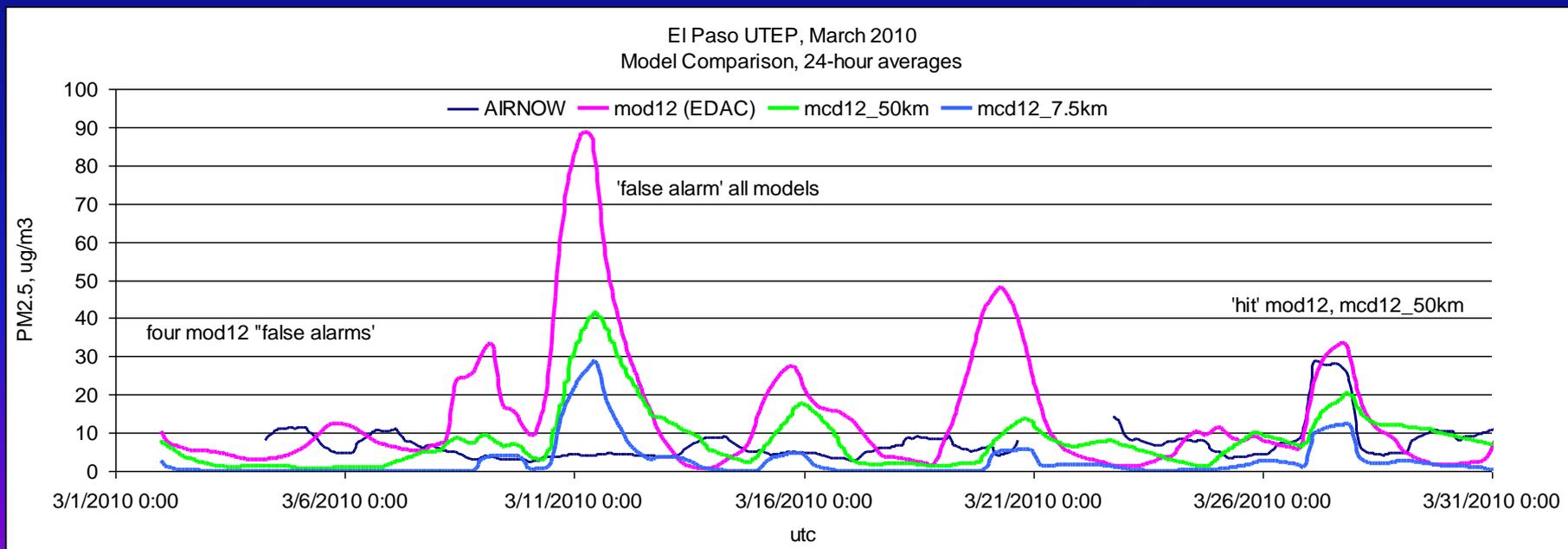
1. UA solved issues at UA comp ctr & tested DREAM/eta with dust masks
2. UNM with MSFC developed plan to validate CALIOP w/ MODIS/AOD
3. MSFC base-lined 2 dust events in CMAQ using WRF-SMOKE
4. A naming convention was created for ENPHASYS inputs and outputs
5. Began routine production of DREAM/eta forecasts using dust masks
6. Transferred CMAQ model grids to model fugitive dust, speciated aerosols, and O₃





Accomplishments Apr 2010 to Sep 2010

1. Compared MOD12 and MCD12 model runs to assess performance
2. Completed model runs to compare MOD12 w/ MCD12 with and w/o dust source updates
3. Installed CMAQ model at EDAC
4. Initiated metadata templates for EPHTS/N products
5. Designed a dust advisory initiative for cities and towns across AZ and NM
6. Processed and evaluated CALIOPE data for verifying aerosol episodes



UNM





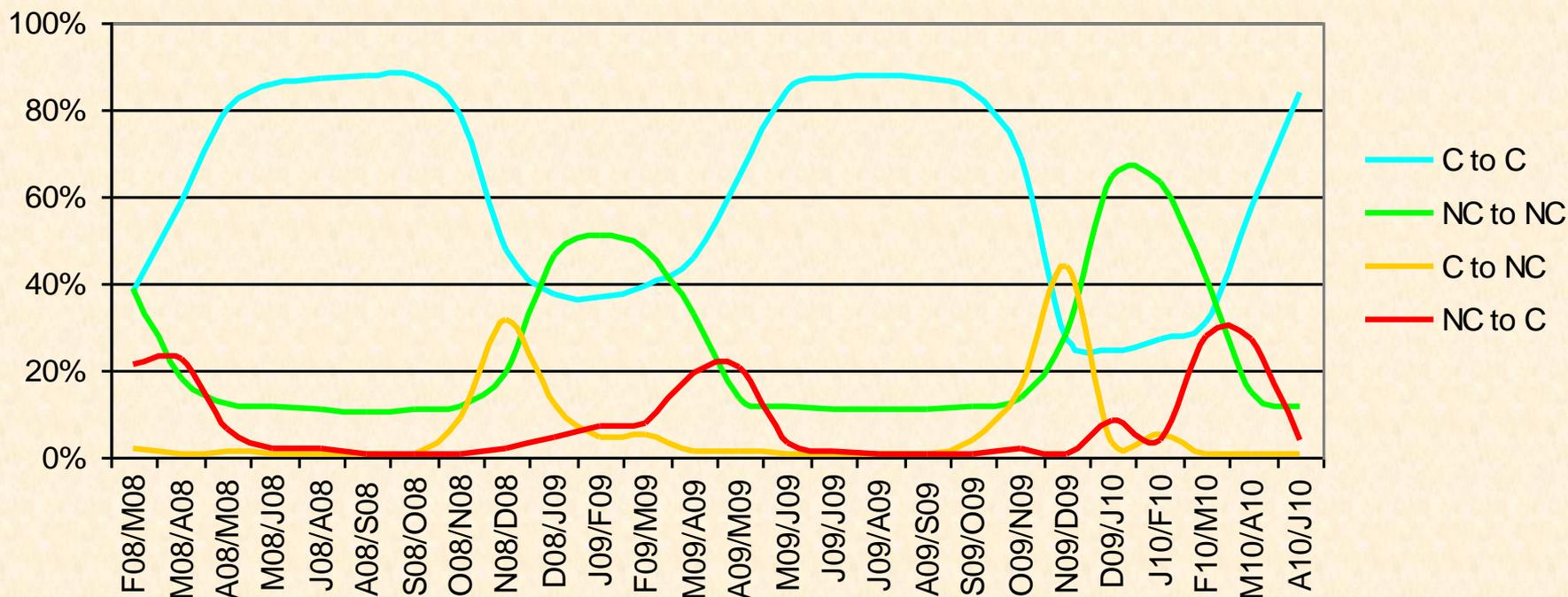
Outreach

- Created / updated brief for *Public Health Highlights*
- Created brief for *PH Accomplishments*
- Created 1-page NASA flyer
- Published peer-reviewed chapter in JBGIS book
- Participated in EOM Conf. & prepared Use Case
- Poster Session at AGU, Dec 2009, San Francisco
- Presented at AMS, Jan 2010, Atlanta
- Presented at ATS, May 2010, New Orleans
- Presented at Space Technology Applications for Socio-Economic Benefits, Sep 2010, Istanbul



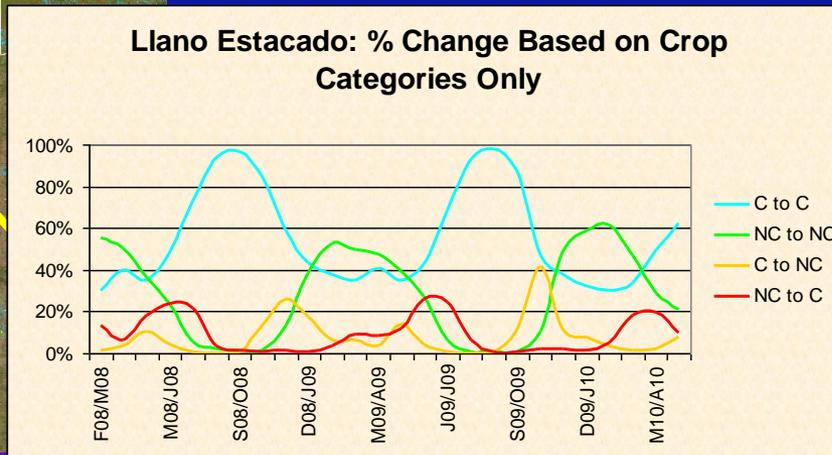
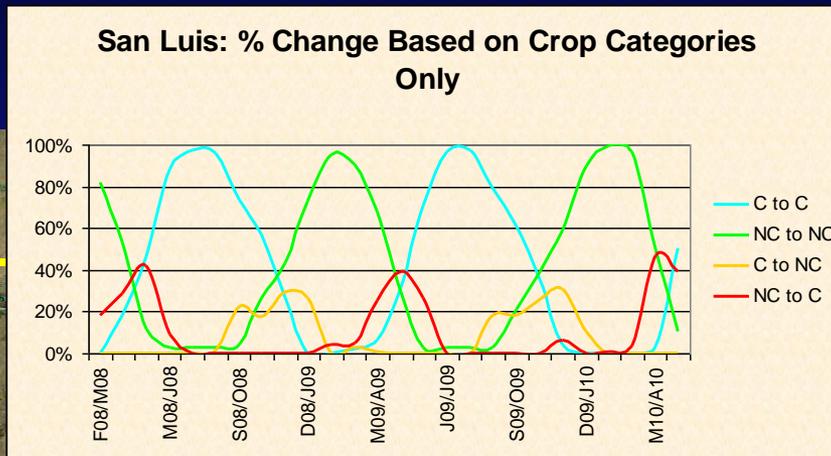
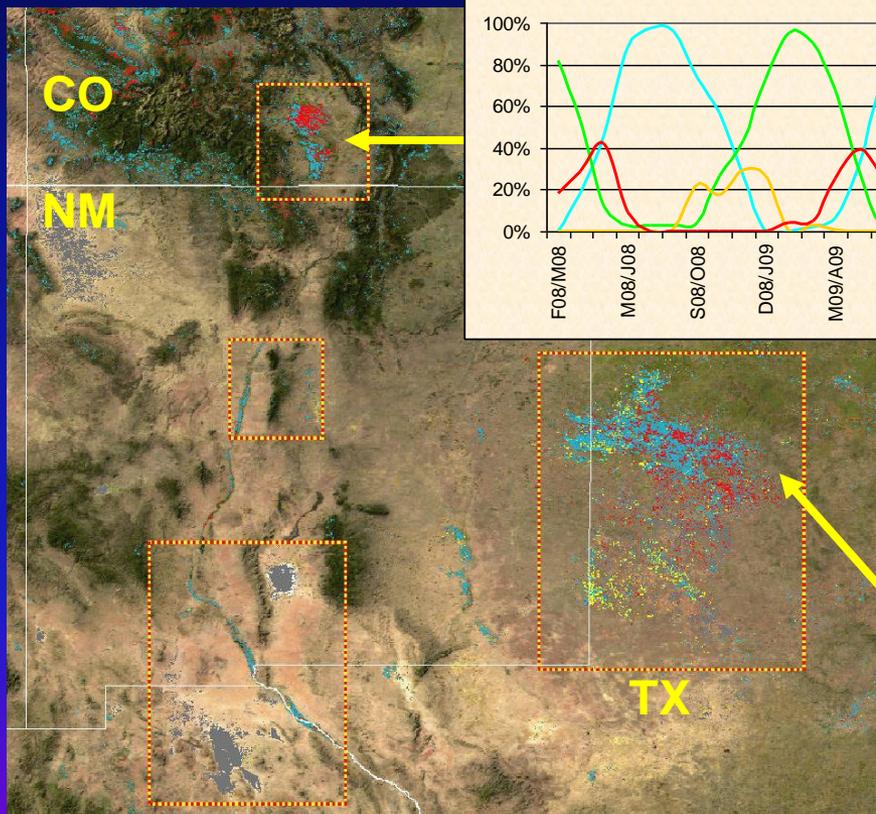
Month-to-Month Changes in Agricultural Dust Sources Across DREAM Domain

DREAM Domain: % Change Based on Crop Categories Only



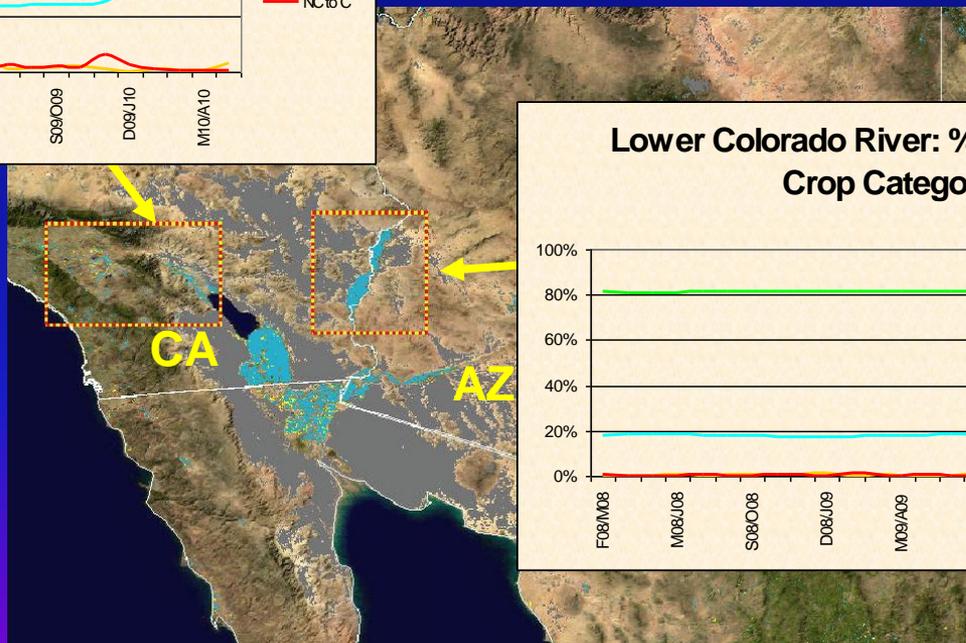
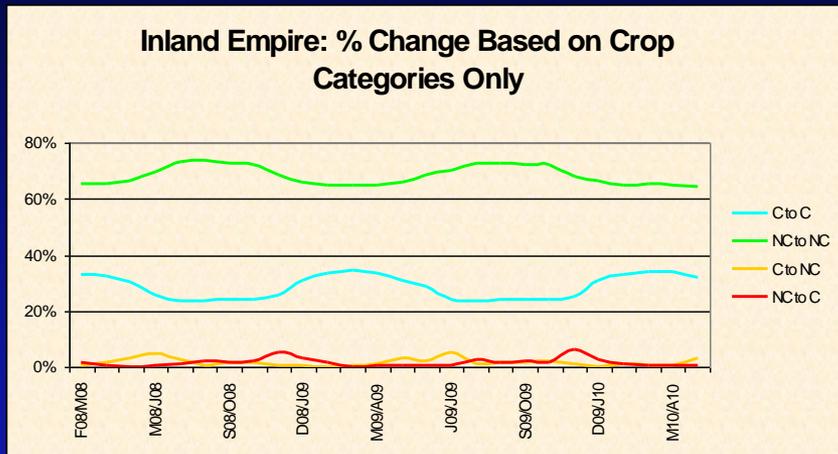


Areas of Greatest Seasonal Variation in Dust Sources from Agriculture





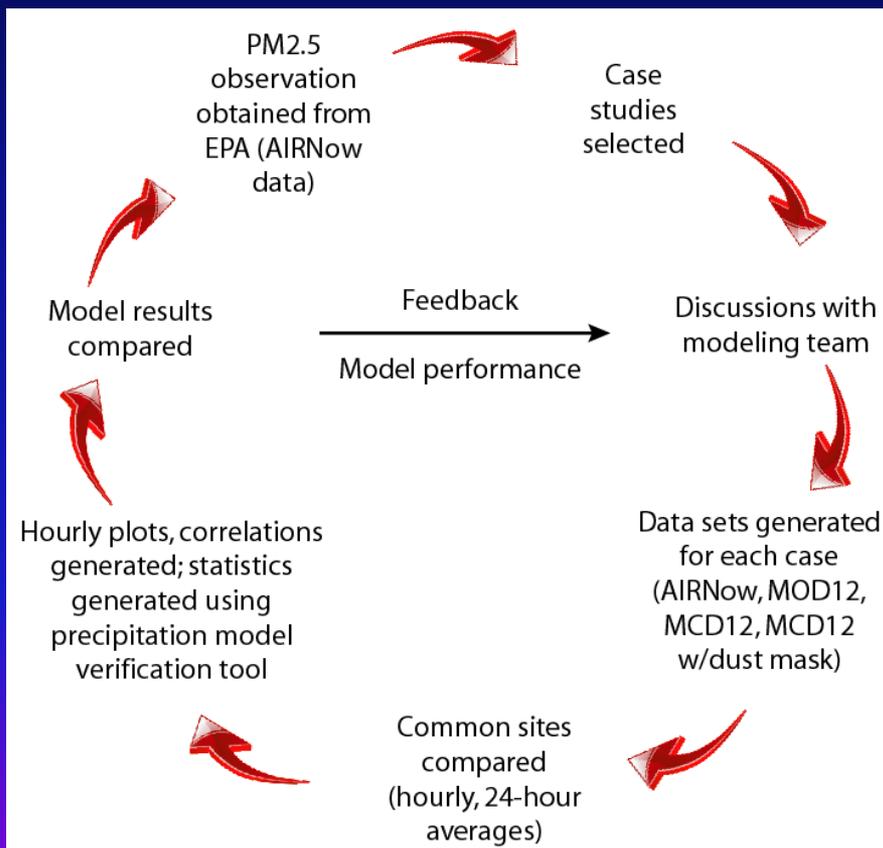
Areas of Least Seasonal Dust Source Variation from Agricultural Fields



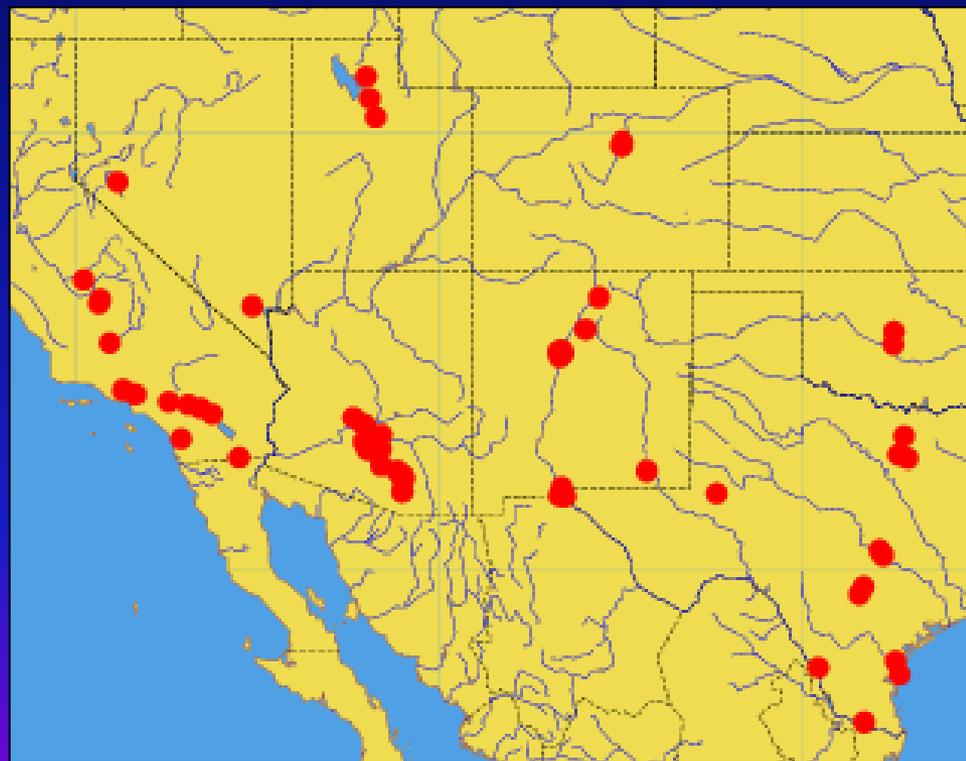


Verification & Validation

V&V Process Steps

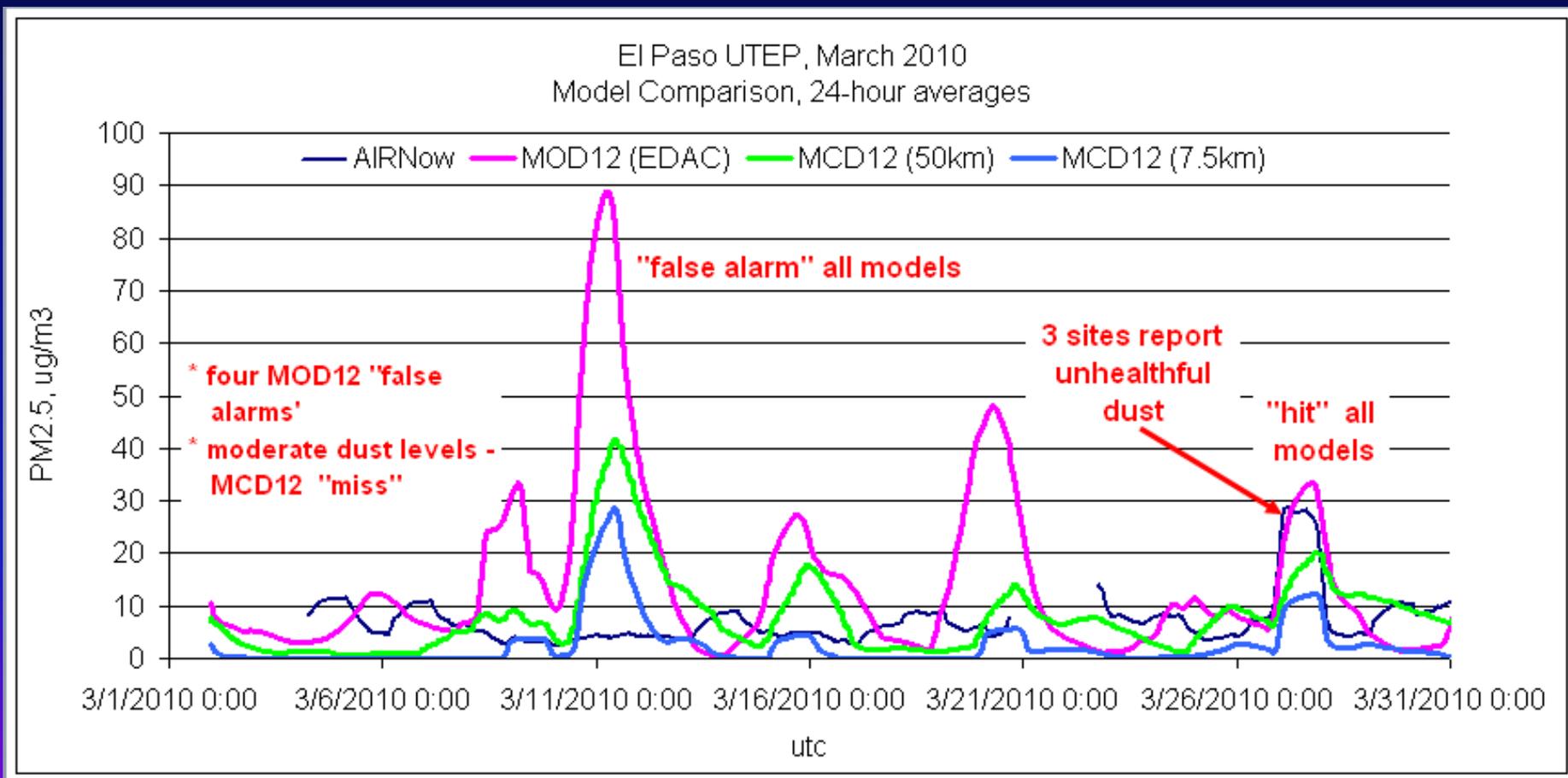


Distribution of PM2.5 AIRNow Stations





Comparing Performance of Models to AIRNow Observations





March 2010 Data Analysis (AIRNow and MCD12 Model Outputs)

Model resolution	# sites modeled	# days	N	Hits	Misses	False alarms	Non-event days	False alarm ratio	# false alarm days, all sites	# false alarm days, southern CA
7.5 km	23	31	713	0	3	17	693	0.02	9	8
50 km	23	31	713	1	3	55	654	0.08	19	13
50 km	59	31	1829	1	3	203	1622	0.11	28	19

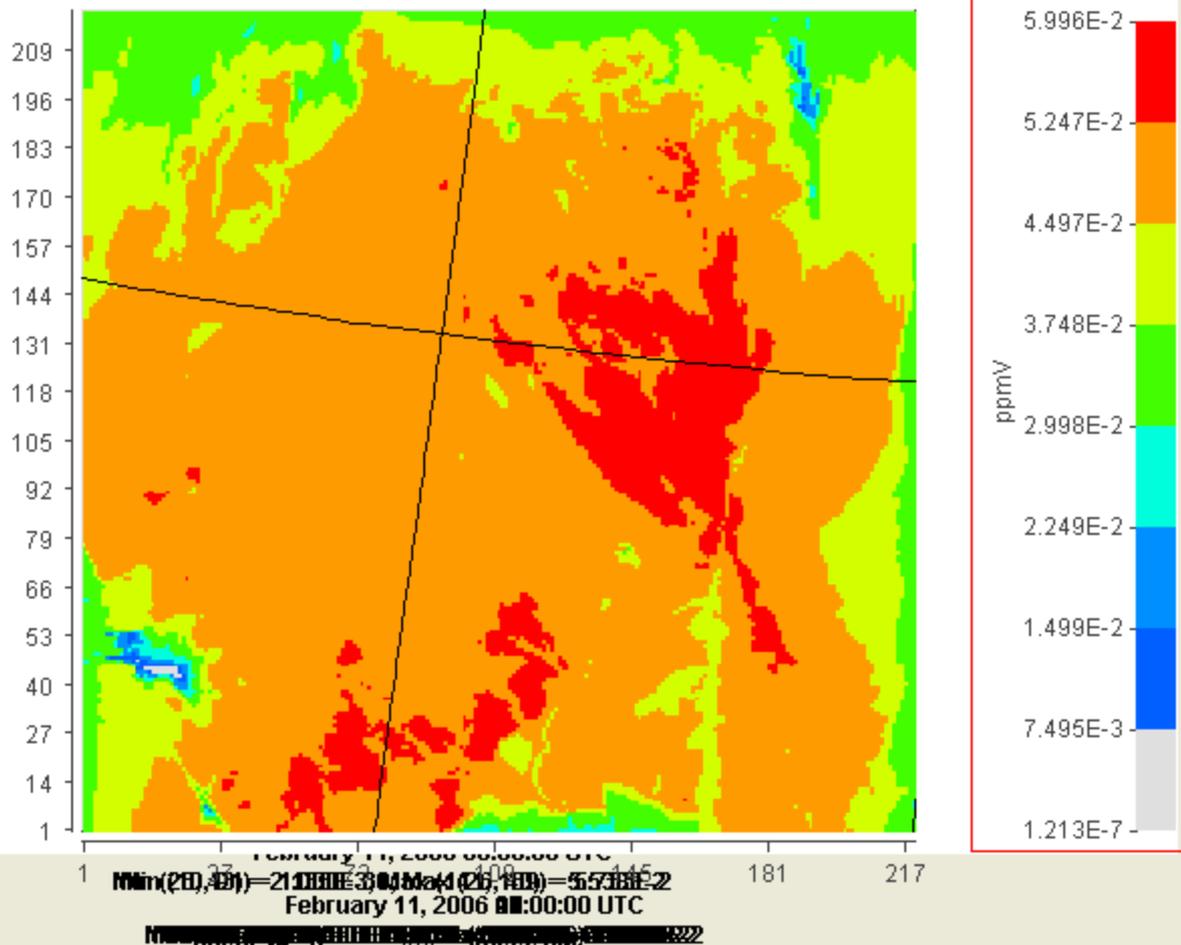
- Model performance evaluated during a relatively “healthy” month for dust
- The low (50 km) resolution model produced a false alarm somewhere in the model domain almost every day (28 of 31 days)
- The high (7.5 km) resolution model produced a 2% false alarm rate, but only one false alarm outside of southern California
- The high resolution model missed the 3/27 event in El Paso; low resolution model indicated a “hit”



Ozone & Aerosol Tasks

Layer 1 O3[3]

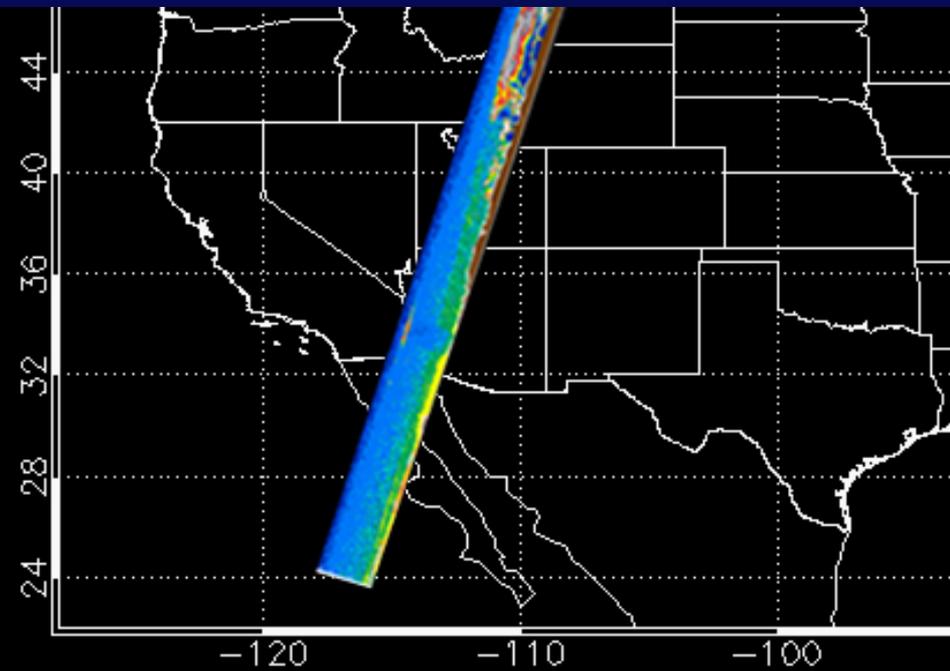
[3]=CCTM_enphasys.ACONC.wus4.20060211



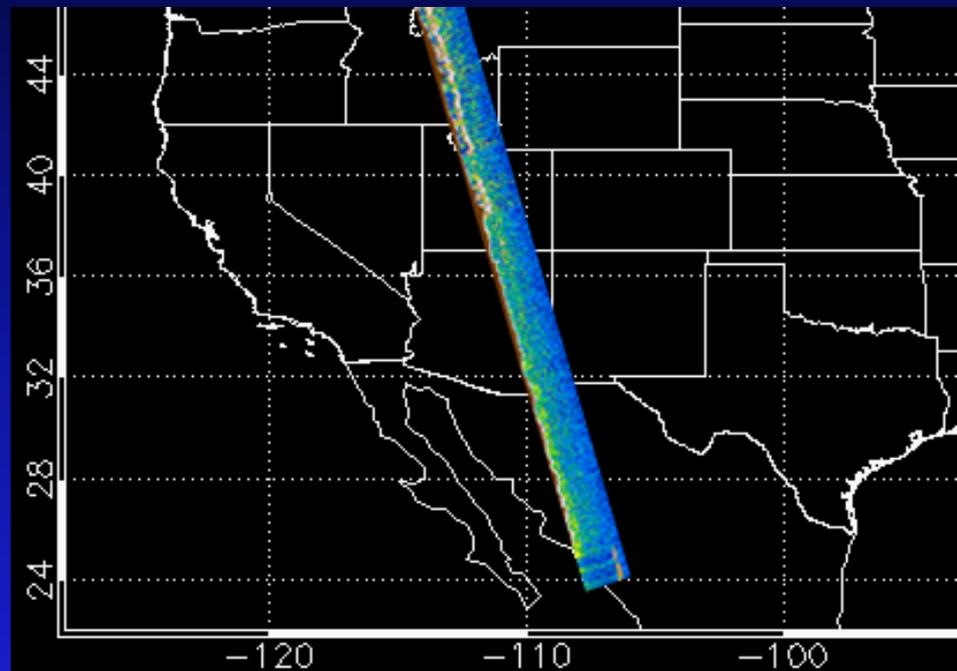


CALIOP Curtains

Ascending and Descending Passes



April 10, 2008 9:00 GMT

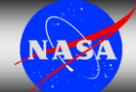
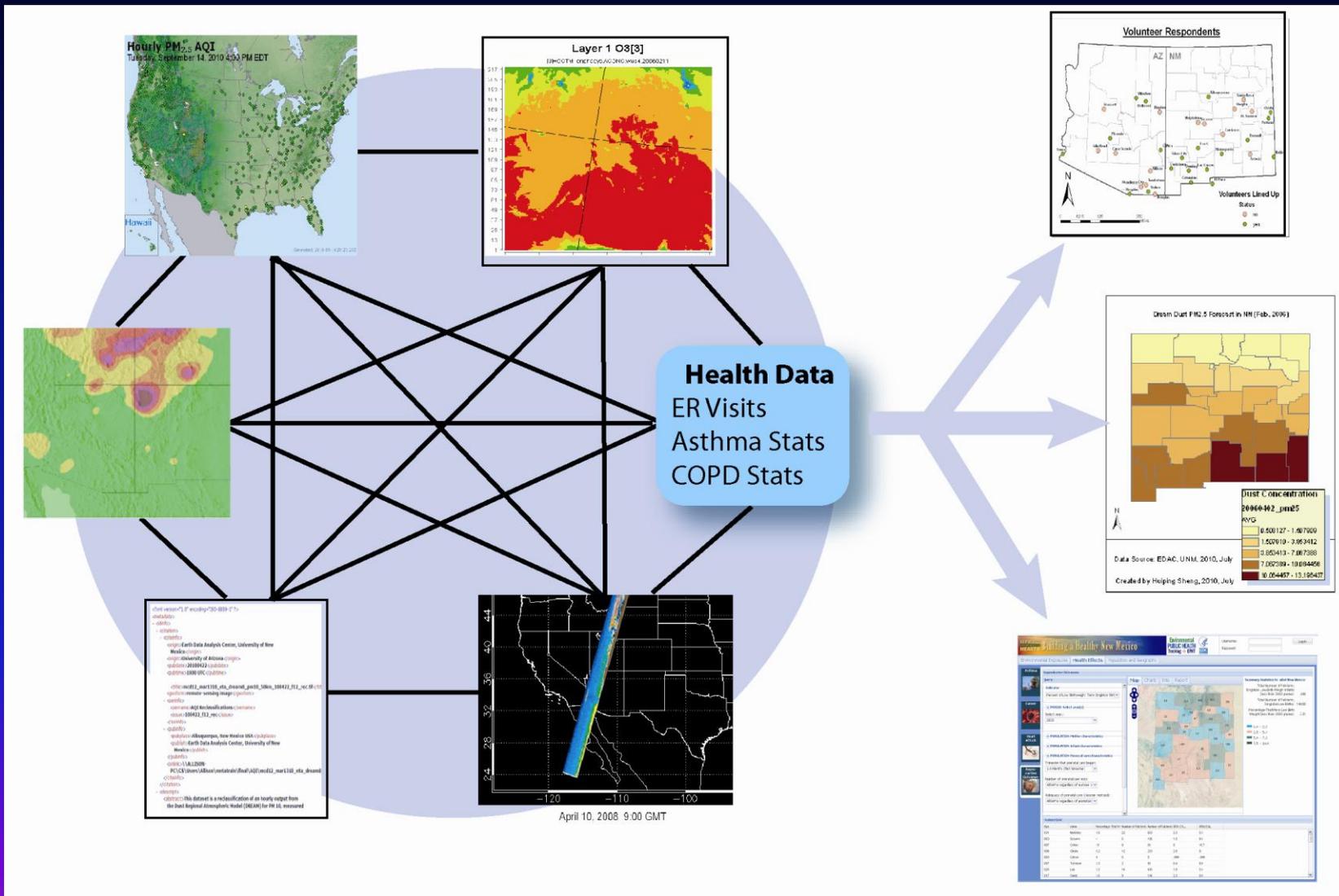


April 10, 2008 20:00 GMT

Using CALIOP data for verification and validation of AOD



Elements of Product Development





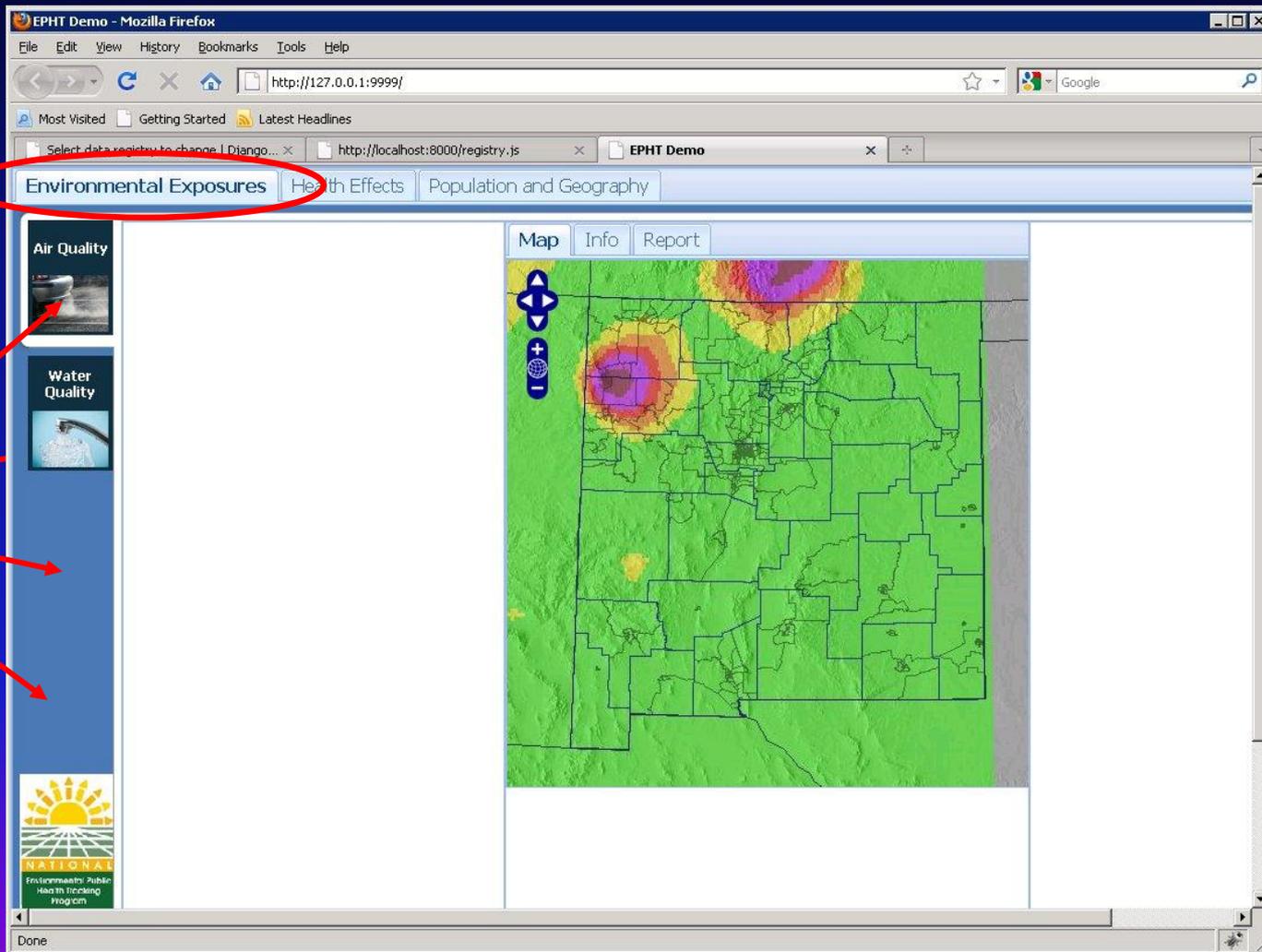
Metadata

- FGDC-compliant metadata created and parsed for:
 - Dust masks
 - Concentrations of PM_{2.5} modeled by DREAM
 - AQI reclassification of PM_{2.5}
 - Daily averages of PM_{2.5} by month
- Automate metadata process for each product line
- Required for data discovery and delivery in EPHT

```
<?xml version="1.0" encoding="UTF-8" ?>
- <metadata>
- <idinfo>
- <citation>
- <citeinfo>
  <origin>Earth Data Analysis Center, University of New Mexico</origin>
  <pubdate>20090820</pubdate>
  <title Sync="TRUE">mcd12_aug2009.tif</title>
  <geoform Sync="TRUE">remote-sensing image</geoform>
  <onlink Sync="TRUE">\\CASSIO2\C$\Amy Files\NASA DECISIONS\Metadata
  <ftname Sync="TRUE">mcd12_aug2009.tif</ftname>
  <pubtime>Unknown</pubtime>
- <serinfo>
  <sername>MCD12 Dust Masks</sername>
  <issue>mcd12_aug2009</issue>
</serinfo>
- <pubinfo>
  <pubplace>Albuquerque, New Mexico USA</pubplace>
  <publish>Earth Data Analysis Center, University of New Mexico</publish>
```



Developing Interface for Health Client Server: NM EPHT via IBIS



Buttons
for pollen,
dust,
ozone,
aerosols



NEW MEXICO DEPARTMENT OF HEALTH **Building a Healthy New Mexico**

Environmental Exposures **Health Effects** Population and Geography

Environmental Exposures **Health Effects** Population and Geography

Reproductive Outcomes Query

Indicator: Percent of Low Birthweight Term Singleton Birth

PERIOD: Select year(s)
Select years.: 2003

POPULATION: Mother characteristics

POPULATION: Infant characteristics

POPULATION: Prenatal care characteristics
Trimester that prenatal care began: 1-3 Months (first trimester)
Number of prenatal care visits: All births regardless of number of
Adequacy of prenatal care (Kessner method): All births regardless of prenatal c

Map Charts Info Report

Summary Statistics for all of New Mexico
Total Number of Full-term, Singleton Low Birth Weight Infants (less than 2500 grams): 490
Total Number of Full-term, Singleton Live Births: 14800
Percentage That Were Low Birth Weight (less than 2500 grams): 3.31

0.0 - 2.5
2.5 - 5.0
5.0 - 7.5
7.5 - 10.0

Feature Grid

fips	name	Percentage That Wi	Number of Full-term	Number of Full-term	95% CI LL	95%CI UL
031	McKinley	3.5	22	633	2.3	5.3
053	Socorro	4	5	126	1.5	9.5
007	Colfax	10	9	90	5	18.7
006	Cibola	5.2	12	233	2.8	9.1
003	Catron	0	0	5	-999	-999
057	Torrance	2.3	2	88	0.4	8.8
025	Lea	3.2	14	435	1.8	5.5
017	Grant	4.6	9	194	2.3	8.9

Sample from Demo of NM EPHT



Asthma



Cancer



Heart Attack



Reproductive Outcomes



Reproductive Outcomes

Query

Indicator: Percent of Low Birthweight Term Singleton Birt

PERIOD: Select year(s)

Select years.: 2003

POPULATION: Mother characteristics

POPULATION: Infant characteristics

POPULATION: Prenatal care characteristics

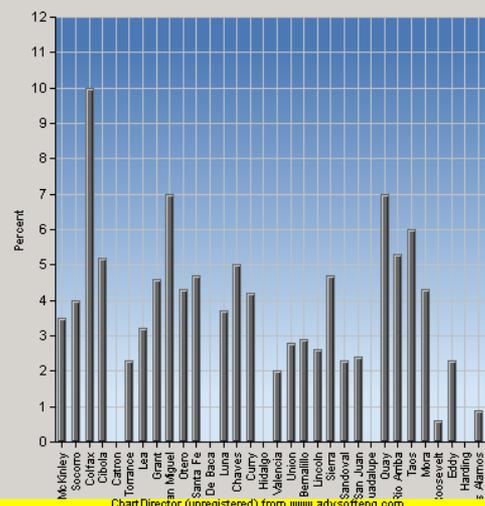
Trimester that prenatal care began: 1-3 Months (first trimester)

Number of prenatal care visits: All births regardless of number o

Adequacy of prenatal care (Kessner method): All births regardless of prenatal c

Map Charts Info Report

Percent of Low Birthweight Term Singleton Births



Summary Statistics for all of New Mexico

Total Number of Full-term, Singleton Low Birth Weight Infants (less than 2500 grams): 490
Total Number of Full-term, Singleton Live Births: 14800
Percentage That Were Low Birth Weight (less than 2500 grams): 3.31

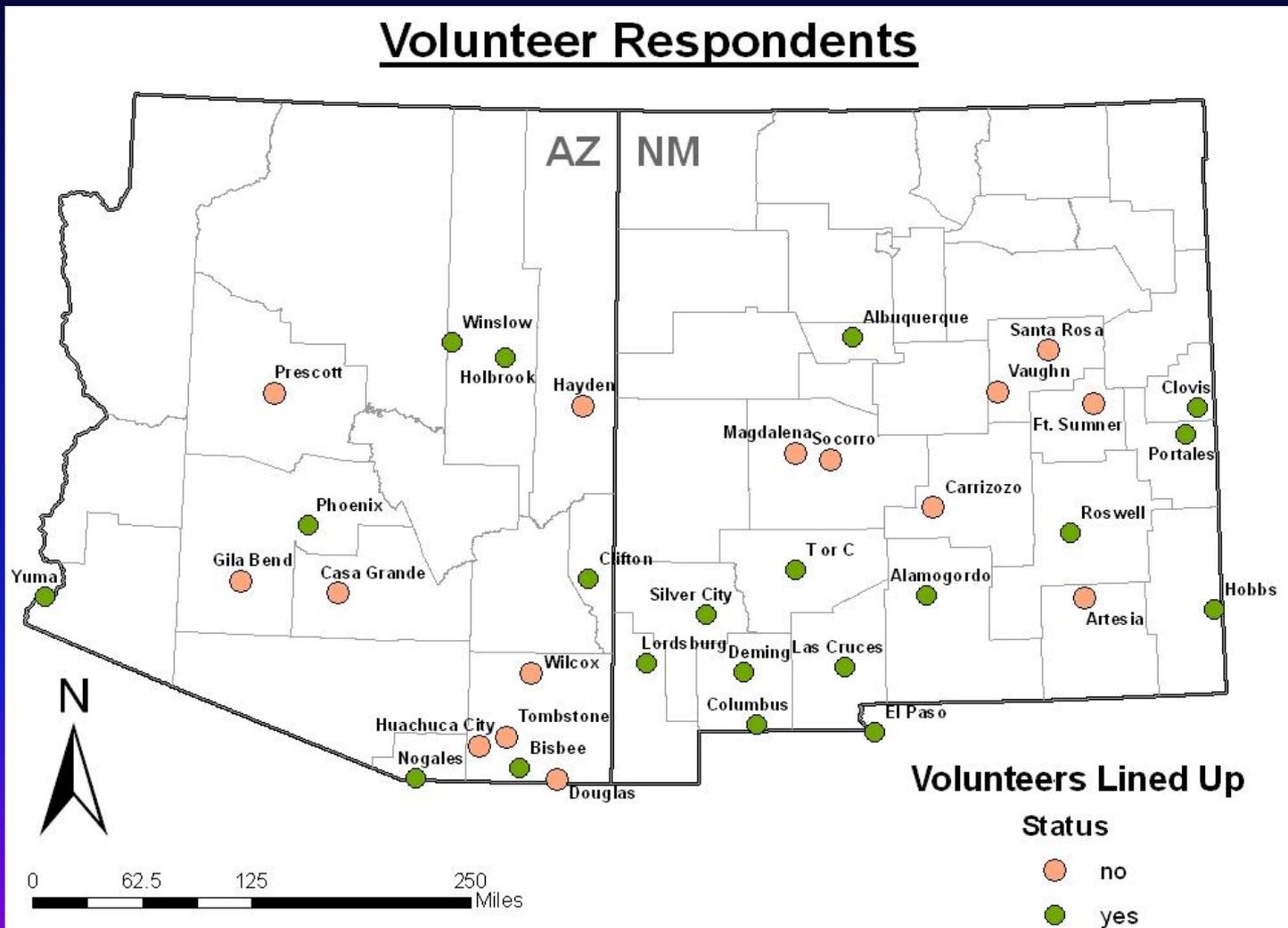
Feature Grid

Table with 7 columns: fips, name, Percentage That Were Low Birth Weight, Number of Full-term, Number of Full-term Singleton Live Births, 95% CI LL, 95% CI UL. Rows include counties like McKinley, Socorro, Colfax, Cibola, Catron, Torrance, Lea, and Grant.

Sample from Demo of NM EPHT



Network of Air Quality Volunteers AZ and NM for Dust Advisory Notices





Challenges

- DOH switch to IBIS
- Scheduling model runs on super computer
- Changes in NOAA's Global Forecast System
- Dust sources north of 35° latitude
- Employee resignation



Project Team

Stan Morain, PI

- Modeling Team

- Bill Sprigg
- Slobodan Nickovic
- Goran Pejanovic
- Ana Vukovic
- Maudood Khan
- Brian Barbaris

- Applications Team

- Amy Budge
- Bill Hudspeth
- Tom Budge
- Karl Benedic
- Hays Barrett
- Matt Gagnon
- Peggy Allison
- Orrin Myers